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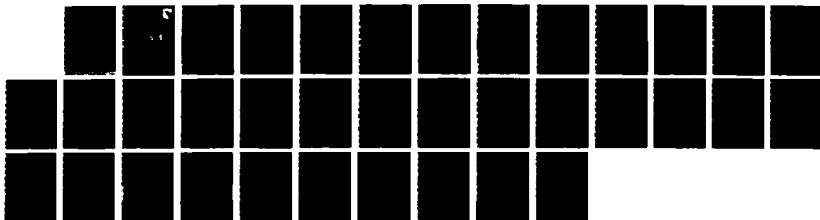
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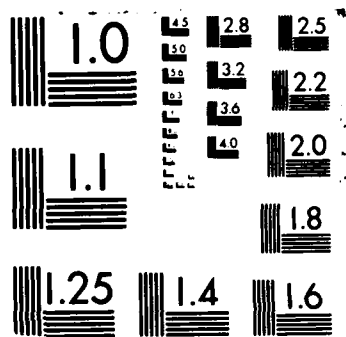
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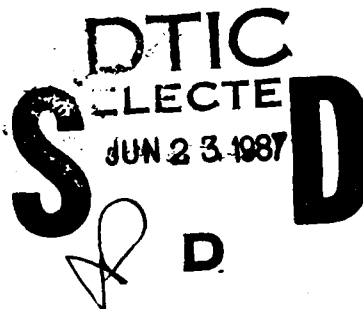
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ANNOTATED BIBLIOGRAPHY OF PSYCHOMOTOR TESTING

CAY ERVIN

ANTHROPOLOGY RESEARCH PROJECT, INC.



MARCH 1987

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HARRY G. ARMSTRONG AEROSPACE MEDICAL RESEARCH LABORATORY
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PREFACE

This study was conducted by the Anthropology Research Project, Inc., under Air Force contract F33615-82-C-0510, Project 718408, with the Harry G. Armstrong Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio. The contract monitor was Kathleen M. Robinette.

Ms. Mary Gross of Anthropology Research Project assisted with the collection of articles. Ms. Ilse Tebbetts and Ms. Jane Reese edited and prepared the manuscript for publication.

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ANNOTATED BIBLIOGRAPHY OF DEXTERITY TESTS

INTRODUCTION

This bibliography contains 67 annotated references concerned with various aspects of dexterity/tactility tests. The references were compiled as the preliminary task in the development of a dexterity test battery which would measure the effects of chemical defense treatment drugs. It became evident in assembling these references that dexterity tests have been used for a wide variety of purposes, including the testing of differences between chemical defense protection gloves, assessment of injuries and/or success of physical therapy, and the investigation of developmental trends in children. Additional topics include the effects of room color, noise, cold and water pressure on dexterity skills. Points of special interest for our purposes were the types of tests used in the studies, learning effects, experimental design, and factor analysis.

A large number of the annotations included in this report are adaptations of summaries or abstracts which appear in the original articles. The annotations do not include any evaluations of the experimental designs by this author and any conclusions drawn are those of the original authors.

Both an author's index and a subject index are provided. Entries in this report are listed alphabetically by senior author and numbered for reference purposes in the use of the two indexes. Thus, in looking up an author or subject, the numbers which appear after the author or subject refer to those numbers assigned to each entry rather than to page numbers.

ANNOTATIONS

1. Andruk, Francis S., James C. Shampine and Dale A. Reins
Aluminized Fireman's (Fire Proximity) Handwear: A Comparative Study of Dexterity Characteristics
Report No. DOD-AG-FSRS-76-17
Navy Clothing and Textile Research Facility, Natick, Mass., 1976
(AD A027 211)

The Navy Clothing and Textile Research Facility (NCTRF) conducted a comparative study of the tactility and dexterity characteristics of several configurations of aluminized fireman's (fire proximity) handwear. The old standard aluminized fireman's glove was compared with that of the recently adopted two-component (glove shell and glove insert) standard and a newly developed experimental prototype which was prepared in three models. The manipulatory capabilities of all the gloves were measured against the bare hand. Twelve subjects performed the Minnesota Rate of Manipulation Test, the Block Packing Test, and the Hand-Tool Dexterity Test. None of the subjects performed all tests, and data were combined by handwear for each task. Subjects were selected at random to wear various gloves and each test was run at least five times with each glove type. Most tests were run ten times. The results indicated that Mod-III of the new experimental prototype exceeded that of the old and new standard and came closest in performance to the ungloved hand. The authors suggested further testing of the Mod III glove.

2. Bachrach, A.J. and P.B. Bennett
Tremor in Diving
Aerospace Medicine, 1973, Vol. 44, No. 6, 613-623

The problem of tremor in diving as part of the high pressure nervous syndrome has been recognized since the mid-1960s. The authors report this phenomenon and discuss methods of objective measurement of tremor. The etiology of tremor is also discussed with specific attention to the question of compression rate and neurophysiological factors which constitute areas of needed research. A matrix of deep dives in which tremor was observed and measured is presented, as well as data from dives in which objective measurement of tremor was achieved.

3. Baddeley, A.D.
Influence of Depth on the Manual Dexterity of Free Divers:
A Comparison Between Open Sea and Pressure Chamber Testing
Journal of Applied Psychology, 1966, Vol. 50, No. 1, 81-85

The manual dexterity and tactile sensitivity of 12 free divers were tested above the surface and at 10 and 100 feet below the surface. The test materials included a screwplate in which subjects transferred 16 nuts and bolts, and two 12-inch rulers bolted together with a gap at one end. The latter was referred to as a V test and subjects were to discern when the gap between the rulers began. Each subject performed the tasks under all three conditions, two subjects being allocated to each of the six possible orders of presentation. The test was then replicated in a dry chamber where subjects

showed much less impairment. The authors concluded that pressure chamber testing cannot be generalized to underwater performance.

4. Barnes, John W., Jr.
Development Test II (Service Phase) Handwear, Wet Weather
USATECOM Project No. 8-EI-485-000-032
U.S. Army Natick Laboratories
Natick, Mass., 1973 (AD 914204)

The Arctic Test Center conducted a test of wet weather handwear to determine its performance in providing protection to the hands during wet weather conditions. The test was conducted at Fort Greely, at Fort Richardson, and in Sitka, Alaska during the period of November 1972 to April 1973 in temperatures ranging from 14°F to 59°F.

The test handwear was worn by 228 participants while conducting field training exercises, range firing, cross-country movement, and airborne and airmobile operations. By observing the operations and interviewing each soldier, the test team collected data on functional performances, fitting, maintenance, human factors, troop acceptability and safety. Data were also collected on cold storage and durability.

The test handwear met 17 of 18 criteria. The test criterion not met was troop acceptability. Subjects complained of discomfort and loss of tactility.

5. Bell, Esther, Kathleen Jurek and Thelma Wilson
Hand Skill--A Gauge for Treatment
The American Journal of Occupational Therapy, Feb. 1976,
Vol. 30, No. 2, 80-86

The authors evaluated a standard objective test of hand skill, the Physical Capacities Evaluation of Hand Skill, which was developed by the Occupational Therapy Department at the Texas Rehabilitation Hospital to test disabled patients. The test battery included the Card Sort Test, Erector Set Test, Bennett Hand Tool Dexterity Test, Pin Count Test, Hand Grip Test, and the Coin Count Test. Test subjects included 124 disabled persons, and 50 subjects who were hospital employees and family members of patients to establish normative data. The authors found that test performance could be affected by psychological variables (such as lack of competitiveness), the specific type of disability (paraplegia, quadraplegia or hemiplegia), and the general poor health which can accompany severe disability.

6. Bensel, Carolyn K. and J.M. Lockhart
Cold-Induced Vasodilatation Onset and Manual Performance in the Cold
Ergonomics, 1974, Vol. 17, No. 6, 717-730

This study was an investigation of manual dexterity capabilities during whole-body cold exposure as a function of time to vasodilatation during local cooling. Thirty male subjects were divided into three equal groups on the basis of time to vasodilatation during the hand cooling tests. Each subject was exposed to ambient temperatures of 15.6° and -6.7°C for three hours while

performing a battery of six manual tasks barehanded. The tasks were Screw Tightening, Purdue Pegboard Assembly, Knot Tying, Cord and Cylinder Manipulation, Minnesota Rate of Manipulation Placing, and Block Stringing. Prior to testing, all subjects had five days of practice on each task at an ambient temperature of 23.9°C. The authors found that during the initial onset of vasodilatation, dexterity improved somewhat but that performances decreased with prolonged exposure.

7. Berchou, Richard and Robert I. Block
Use of Computerized Psychomotor Testing in Determining CNS
Effects of Drugs
Perceptual and Motor Skills, 1983, Vol. 57, 691-700

This investigation was concerned with the sensitivity of computerized test performance to the effects of diazepam (Valium) and lorazepam (Ativan) which are antidepressants, and dextroamphetamine. The test battery included the Visual Analogue Sedation Rating in which subjects rated their feelings of alertness or drowsiness, the Critical Flicker Fusion (CFF), and the Discriminant Reaction Time tasks (DRAT). During the CFF (which was controlled by an IBM 800 computer) subjects placed their head against a face mask and viewed two light-emitting diodes within a black-coated viewing chamber through artificial pupils which were 2 mm in diameter. Subjects were instructed to determine which of the two diodes was flicking and to respond with the appropriate switch. Subjects also received feedback regarding the correctness of their response by a tone. The DRAT, which used the same computer as the CFF task, involved viewing a small screen which flashed a series of single digit numbers. Subjects were instructed to respond when a particular number appeared. The interstimulus interval was increased for incorrect responses and decreased for correct responses. Baseline performance was established before ingestion of medication or placebo. Subjects then completed the battery every half hour for four hours for a total of eight test sessions. The order of drug conditions was random and was administered in a double-blind design.

The results indicated that both tasks appeared to be sensitive to the effects of diazepam and lorazepam but not dextroamphetamine. The authors comment that computerized testing is a promising method of testing CNS drugs. The administration of the tests is easy to control, the tests are brief, and appear to be sensitive to the time course of drug effects.

8. Bhattacharya, S.K., Aparna Roy and S.K. Chatterjee
Comparison of Motor-Manual Performance in Quiet and
Noisy Environments
Indian Journal of Medical Research, August 1978, Vol. 68, 306-311

Motor manual performance was tested in quiet and noisy environments on 20 subjects. The tests administered were manual dexterity, finger dexterity, motor coordination and steadiness. Physiological parameters, such as pulse rate, oral temperature and blood pressure were observed before, during and after exposure in both quiet and noisy situations. Noise was generated by an oscillator and played through a set of speakers. The noise level generated in the room was 100 dBA at a frequency of 10,000 CPS. The motor manual

performance of the subjects showed improvement in the noisy environment as compared to their performance in a quiet situation.

9. Bird, Anne Marie

Cross Sex Effects of Subject and Audience During Motor Performance
The Research Quarterly, 1975, Vol. 46, No. 3, 379-384

The primary purpose of this investigation was to test the hypothesis that there would be no interactive effects between sex of subject and sex of audience during performance of two motor tasks. An auxiliary purpose was to examine performance of two motor tasks in an effort to determine if performance would vary according to the sex of the subject. Forty-eight subjects, 24 males and 24 females, were randomly assigned to one of four treatment conditions: male subjects with male audience, male subjects with female audience, female subjects with male audience, and female subjects with female audience. All subjects completed three trials on two motor tasks: the Nine-hole Steadiness Test and the Minnesota Rate of Manipulation Turning Test. The 2 x 2 factorial design was subjected to a multivariate analysis of variance. No interactive effects were found between sex of subject and sex of audience. However, results strongly suggest that certain tasks may be sex-performance related because of task performance demands.

10. Bourassa, G. Lee and Robert M. Guion

A Factorial Study of Dexterity Tests
Journal of Applied Psychology, 1959, Vol. 43, No. 3, 199-204

In this study the authors attempted to identify five distinct factors of fine manipulative work -- manual dexterity, finger dexterity, tweezer dexterity, visual acuity and depth perception. Fifteen tests were administered to 100 female volunteers. While the data supported three of the factors, there was no support found for the factors of tweezer dexterity and finger dexterity. The authors hypothesized that failure to identify these factors may have been due to the random order of test administration. (These factors had been identified in earlier research in which the test order was not random.)

11. Brady, John I., Jr.

Surface Practice, Level of Manual Dexterity and Performance
of an Underwater Assembly Task
Human Factors, 1979, Vol. 21, No. 1, 25-33

Performance of an underwater assembly task was examined as a function of surface practice and level of manual dexterity. Surface practice transferred positively to underwater performance of the task. Manual dexterity scores were positively correlated with underwater performance, but the results were not statistically significant.

12. Carter, Robert C., Deborah A. Stone and Alvah C. Rittner
Repeated Measurements of Manual Dexterity: Applications
and Support of the Two-Process Theory
Ergonomics, 1982, Vol. 14, No. 9, 829-838

The Minnesota Rate of Manipulation Test Placing, and Turning tasks were studied for suitability for repeated measures applications: training evaluation, selection and environment research. Twenty male volunteers performed four runs of Placing and Turning in each of 15 daily trials. The tasks were evaluated in terms of the amount of practice required to yield scores with homogeneous variances and inter-trial correlations, and means with a linear trend across days. Results revealed that means for both tasks increased linearly in a parallel fashion, and variances were homogeneous after the third day. Inter-trial correlations were homogeneous after the third day for turning, and after the 10th day for placing. Jones' two-process model of skill acquisition states that the early trials reflect rate of learning, and later trials reflect the final rate of performance achieved. Implications for personnel measurement and intervention experiments were also discussed. The authors recommend that the stability of measures be considered prior to use.

13. Cattroll, S.W.
Dexterity Comparison Between Canadian and French CW Gloves
Report No. TN 82-36
Defence Research Establishment Ottawa, Canada,
September 1983 (AD B079169)

A study of the effects of wearing the Canadian Chemical Warfare (CW) glove and the French CW glove on manual performance, as compared with bare hand performance, in four different manual dexterity tests is described. Five subjects performed four tests (Bennett Hand Tool Dexterity Test, Minnesota Two Hand Turning Test, O'Connor Fine Finger Dexterity Test and Cord Manipulation and Cylinder Stringing Test) under three conditions for 14 days. For data analysis, only results for the last seven days were used. The results show that there is a significant decrement in performance when wearing the two types of gloves, but no significant differences in manual dexterity were detected between the Canadian and French CW gloves.

14. Clark, R. Ernest
The Limiting Hand Skin Temperature for Unaffected Manual
Performance in the Cold
Journal of Applied Psychology, 1961, Vol. 45, No. 3, 193-194

In this study Clark sought the hand skin temperature at which dexterity became affected. The knot-tying performances of 12 enlisted men were measured at 60°F and 55°F following 20, 40 and 60 minutes of exposure. It was found that performance was severely hindered when hand skin temperature fell to 55°F, and that performance decrements at this skin temperature level were increasing exponential functions of duration of exposure, becoming asymptotic after 40 minutes of exposure. Performance at 60°F was unaffected throughout the exposure period.

15. Consroe, P., Elisaldo A. Carlini, Asteroids P. Zwicker and
Luiz Alveline Lacerda
Interaction of Cannabidiol and Alcohol in Humans
Psychopharmacology, 1979, Vol. 66, 45-50

The authors investigated the interactive effects of cannabidiol (CBD) and alcohol on human motor and cognitive skills. Each of the 10 subjects performed tests in all of the treatment conditions - placebo, CBD, alcohol, and alcohol with CBD. Treatment conditions were in random order with one week between conditions. Subjects were tested immediately before and at 30, 60, 120 and 240 minutes following drug or placebo ingestion. The test battery took approximately 25 minutes to complete and included the following: Cancellation Test (drawing lines through targeted numbers), the Differential Aptitude Test which measured attention and concentration, a Time Production Task in which subjects estimated when 60-second intervals had passed, a Finger Tap Test in which scores equaled the number of taps made in one minute, and a subjective Drug Reaction Scale. The results indicated that alcohol and alcohol with CBD, but not CBD alone, produced decrements of motor and cognitive responses.

16. Droege, Robert C. and John Hawk
The Great Wood vs. Plastic Pegboard Controversy: A
Definitive Answer
Journal of Employment Counseling, September 1976, 102-104

This study was performed to resolve the question of comparability of manual dexterity scores obtained on wooden and plastic versions of the U.S. Employment Service (USES) pegboard. Three types of boards (new wooden, worn wooden, and plastic) were used in testing 456 individuals, 152 with each type. The results showed that there were no significant differences in mean. The authors concluded that currently authorized equipment, either plastic or wooden, may be used with the confidence that scores are not affected by the type of equipment used. Users of plastic equipment should make certain that only the newer hard plastic pegs are used, however.

17. Fleishman, Edwin A.
Psychomotor Test II BM 122 AX2
Air Training Command Human Resources Research Center
Lackland Air Force Base, San Antonio, Texas, 1952

This is a test booklet of paper and pencil dexterity tests designed by the author for testing Air Force personnel. Directions and sample forms for the following tests are included: Medium Tapping, Large Tapping, Aiming, Pursuit Aiming I, Pursuit Aiming II, Square Marking, Tracing, Steadiness and Discrimination Reaction Time.

18. Fleishman, Edwin A.
Testing for Psychomotor Abilities by Means of Apparatus Tests
Psychological Bulletin, July 1953, Vol. 50, No. 4, 241-262

In this paper, an attempt has been made to examine the area of psychomotor skills research from the point of view of aptitude test development. The historical background of psychomotor test development is presented, problems attending the use of such tests are discussed, and previous factor analysis studies in this area are summarized. Suggested directions of future research are discussed in terms of possible research approaches and certain methodological problems having research implications.

19. Fleishman, Edwin A. and Walter E. Hempel Jr.
Changes in Factor Structure of a Complex Psychomotor Test as
a Function of Practice
Psychometrika, September 1954, Vol. 19, No. 3, 239-252

Scores obtained at eight different stages of practice on the Complex Coordination Test together with scores on 18 reference tests were subjected to a Thurstone centroid factor analysis. Nine meaningful factors were identified in the experimental battery. Factorially, the test became considerably and systematically less complex with continued practice. Moreover, there was a shift in the nature of the factors contributing variance at early and later stages of practice from non-motor to motor factors. Implications of the findings are related to certain problems of learning theory, psychomotor test development, and criterion analysis.

20. Fleishman, Edwin A.
Dimensional Analysis of Psychomotor Abilities
Journal of Experimental Psychology, 1954, Vol. 48, No. 6, 437-454

For this study 27 apparatuses and 11 printed psychomotor tests were selected and specifically designed to measure selected ability categories. After extensive pretesting, the tests were assembled into a battery and administered to 400 basic trainee airmen. The correlations among scores on these tests were then subjected to a Thurstone centroid factor analysis.

The results of the study appear to confirm the existence of the following relatively independent factors in psychomotor skill: (1) wrist-finger speed, (2) finger dexterity, (3) rate of arm movement, (4) manual dexterity, (5) arm-hand steadiness, (6) reaction time, (7) aiming, (8) psychomotor coordination, (9) postural discrimination, and (10) spatial relations.

The results were discussed with respect to the factor comparison of individual tests, the utility of certain printed tests designed to reproduce apparatus test variances, and the contribution of these factors to certain kinds of more complex psychomotor performance.

21. Fleishman, Edwin A. and Walter E. Hempel, Jr.
Analysis of Complex Psychomotor Performance and Related Skills
The Journal of Applied Psychology, 1956, Vol. 40, No. 2, 96-104

This study is an extension of the Air Force studies conducted in 1947-48 in which a wide variety of printed and apparatus tests were assembled and administered to over 1,000 Navy pilot candidates. This paper describes a factor analysis of the intercorrelations among certain variables selected from the correlation matrix published in another report. The analysis included 23 test variables of which 16 were apparatus psychomotor tests and seven were printed tests designed as possible substitutes for the apparatus tests. Using the Thurstone centroid method, nine factors were identified. Of these, four were confined to apparatus tests, and four factors were found measurable by both apparatus tests and certain printed tests. A perceptual speed factor was found confined to printed tests.

22. Fleishman, E.A.
Dimensional Analysis of Movement Reactions
Journal of Experimental Psychology, 1958, Vol. 55, 438-453

This study confirms previous indications that selected movement reaction tasks may be grouped into several broad classes representing common ability requirements. The ability categories inferred from the factor analysis results were labeled: fine control sensitivity, multiple limb coordination, and response orientation. A factor called rate control was considered more tentative. Definitions of these factors and the diverse kinds of tasks to which they apply are described. Three other factors were identified as arm-hand steadiness, reaction time, and speed of arm movement, but these did not contribute to performance in the more complex movement reaction tasks under the present conditions of administration.

23. Fleishman, Edwin A. and Gaylord D. Ellison
A Factor Analysis of Fine Manipulative Tests
Journal of Applied Psychology, 1962, Vol. 46, No. 2, 96-105

This study replicated earlier work but it was based on a much larger sample, drawn from a different population, and it included some different apparatus tests. The results confirmed the factorial invariance found in this area. Three factors, manual dexterity, finger dexterity, and speed of arm movement, were measured by apparatus tests. Earlier studies had indicated that arm-hand steadiness should be added, according to the authors. They suggest that two factors of more limited scope -- wrist-finger speed and aiming -- are best measured by printed tests. The authors conclude that better tests of manual dexterity are needed since the available tests are impure, and load on the finger dexterity factor.

24. Fleishman, Edwin A. and Marilyn K. Quaintance
Taxonomies of Human Performance. The Description of Human Tasks
Academic Press, Inc., 1984

This book deals with conceptual and methodological issues in developing useful taxonomic structures in various areas of the behavioral sciences and relates these to developments in other sciences. Some of the material is based on an extensive research program directed by the first author. This program attempted to develop and evaluate systems for describing and classifying tasks that could improve predictions about human performance. Emphasis is on a common task-descriptive language to integrate the human performance research literature and improve generalizations of research findings.

25. Gianola, Salvatore V. and Dale A. Reins
Preliminary Studies on the Development and Testing of Low-Temperature Handwear with Improved Dexterity (Report No. 1)
Report No. 106
Navy Clothing and Textile Research Facility
Natick, Mass., 1972 (AD 754 067)

In this study the current Navy cold weather handwear was compared with four experimental glove types. The goal was to find handwear which provides maximum protection against cold without detracting from dexterity performance. Ten volunteers completed the Minnesota Rate of Manipulation Two-Hand Placement Test, a block packing test and the Bennett Hand Tool Dexterity Test. Subjects practiced each test with each of the different glove types until scores were within six to 10 percent variation (most subjects required three to six practice trials for each test). Data were then collected for five timed trials. Results indicated that the standard Navy glove inhibited dexterity and tactile discrimination to a much greater degree than did the experimental designs in all tests.

26. Gianola, Salvatore V., Dale A. Reins and James C. Shampine
Low-Temperature Handwear with Improved Dexterity (Report No. 2)
Report No. 117
Navy Clothing and Textile Research Facility, Natick, Mass., 1976
(AD A037 535)

This study describes tests of second-generation models of experimental prototypes which proved superior to the Navy standard in all dexterities, and provided equal protection in low-temperature environments. The best prototype was selected and a limited number of gloves were constructed for field tests at various Alaskan military sites. Test subjects completed practice runs of the Minnesota Rate of Manipulation Two-Hand Turning Test, a block packing test and the Bennett Hand Tool Dexterity Test until the time difference for performance was five seconds or less. Subjects then completed each test five times with each glove type. The experimental gloves were found superior to the standard Navy gloves on dexterity tests but less protective against severe cold.

27. Gloss, Davis S. and Miriam Gayle Wardle
Use of a Test of Psychomotor Ability in an Expanded Role
Perceptual and Motor Skills, 1981, Vol. 53, 659-662

The purpose of this study was to examine the usefulness of a test of psychomotor ability in the assessment of physical disability. The disability ratings of 118 persons with permanent impairment of one hand were correlated with scores of the O'Connor Finger Dexterity Test. Scores showed a correlation of .69 between these two instruments. Scores on the O'Connor test were strongly correlated to the activities-of-daily-living subscale of the Hand Disability Rating Scale (.88), while rating of disability was not. Age appeared unrelated to either test or disability scores.

28. Gloss, David S. and Miriam Gayle Wardle
Use of the Minnesota Rate of Manipulation Test for
Disability Evaluation
Perceptual and Motor Skills, 1982, Vol. 55, 527-532

This study involved the validation of the Minnesota Rate of Manipulation Test in assessing permanent disability of the hand. One hundred eighteen persons with permanent impairments of the hand were given four subtests of the Minnesota Rate of Manipulation Test. The impaired hand was assessed with the traditional measure for permanent impairment and a rating was obtained. Scores for the impaired hand on each of four subtests were strongly correlated with the rating of disability.

29. Goodfellow, R.A.H. and Patricia Cain Smith
Effects of Environmental Color on Two Psychomotor Tasks
Perceptual and Motor Skills, 1973, Vol. 37, 296-298

A popular viewpoint holds that various hues will have differential effects on activation level and psychomotor performance. To test the performance hypothesis, 125 subjects performed two psychomotor tasks (Rotary Pursuit and the Crawford Small Parts Dexterity Task) in one of five booths painted red, green, blue, yellow and gray. Colors were matched for brightness and saturation and ambient light level was equated for each booth. Subjects also gave preference rankings of the five colors. Results show high agreement in preference rankings of the colors - blue was the most preferred color, followed by green, red, yellow and gray, in that order. There were no significant differences in performance, however, between groups on any task.

30. Graham, Charles and Mary R. Cook
Effects of Pyridostigmine on Psychomotor and Visual Performance
AFAMRL-TR-84-052
Aerospace Medical Research Laboratory
Wright-Patterson Air Force Base, Ohio, 1984

Pyridostigmine is a reversible anticholinesterase inhibitor used in the medical treatment of the neuromuscular disorder myasthenia gravis. Because of the site on which the drug acts (the myoneural junction) and the reversible nature of its action, this drug is currently being considered by the USAF for

field use as a pretreatment medication to aid pilot survival in the event of a chemical attack.

Although health risks appear minimal, there exists a significant need to evaluate the impact of the drug on human functions important to pilot operations. In this study, a double-blind crossover experimental design was used to evaluate the effects of an oral regimen of pyridostigmines on the performance, physiology, and subjective state of 24 paid male volunteers.

31. Greene, Edward B.

An Analysis of Random and Systematic Changes with Practice
Psychometrika, 1943, Vol. 8, No. 1, 37-52

Six motor tests and six non-verbal tests of observation and comparison were administered four times in one week to 394 adolescent boys enrolled in a trade school. Observations and subjective reports of changes with practice were compared to quantitative results. The more complex tests showed more improvement with practice, more reduction in coefficients of variation, and less predictability than did the less complex tests. Subjective reports indicated more varieties of approach to complex than to easy tasks, and more elimination of useless acts, among the complex tests, through methodical habit forming.

All except one test showed marked shifts in the size of factor loadings with practice. The shift was usually toward a larger loading on one factor and smaller loadings in all the rest. The presence of one test which maintained one factor pattern throughout the practice series points to the possibility that more tests with constant factor patterns may be constructed.

32. Guion, Robert M. and Andrew S. Imada

Eyeball Measurement of Dexterity: Tests as Alternatives to Interviews
Personnel Psychology, 1981, Vol. 34, 31-36

As industry's most popular selection device, the interview is too often misused to measure or predict numerous skills and abilities that can be measured or predicted better by other methods. The authors encountered such an abuse in a recent allegation of sex discrimination. This paper reports on a study conducted for this litigation.

In this study six subjects examined the hands of 32 stimulus persons. For each pair of hands, each subject made a judgment of probable level of dexterity, using a nine-point rating scale. Anthropometric measurements, plus sex, were used in a stepwise multiple regression equation to predict the ratings made by each individual judge. The ratings were used to predict scores on the O'Connor Tweezer Dexterity Test. Finally, the anthropometric measures were used, with sex, to predict test scores. The authors conclude that the results demonstrate an inappropriate use of a selection technique to predict an ability that can be better measured by a test.

33. Harrell, Willard
A Factor Analysis of Mechanical Ability Tests
Psychometrika, 1940, Vol. 5, No. 1, 17-33

The intercorrelations of 37 variables, including the Minnesota battery of "mechanical ability" tests, the seven MacQuarrie tests of "mechanical ability," O'Connor's wiggly blocks, and the Strenquist Picture-Matching Test, were analyzed by Thurstone's centroid method. Five factors -- perceptual, verbal, youth, manual agility, and spatial -- were taken out. Factors prominent in so-called mechanical ability tests are the spatial and perceptual ones with MacQuarrie's dotting test significantly high in the manual agility factor. Each of the factors can be measured with group pencil-and-paper tests.

34. Harris, Michael, Herbert Cross and Renee VanNieuwkerk
The Effects of State Depression, Induced Depression and Sex on
the Finger Tapping and Tactual Performance Tests
Clinical Neuropsychology, Vol. 3, No. 4, 28-33

Two experiments were conducted to examine the effects of common emotional states and induced mood on neuropsychological tests. Experiment #1 compared depressed and nondepressed college students on the Finger Oscillation Test (FOT) and Tactual Performance Test (TPT). A correlational experiment demonstrated sex differences on the FOT; males were superior for both preferred and nonpreferred hands. Depressed subjects performed more slowly on the TPT, preferred hand. Experiment #2 compared FOT and TPT performances following bogus negative, bogus positive, and accurate feedback on a shortened version of the Halstead-Reitan Categories Test. Results for females demonstrated changes in rated ability and self-image but no significant changes in mood. Negative feedback subjects showed significantly slower tapping rates with preferred and nonpreferred hands on the FOT compared to accurate and positive feedback subjects. The results are discussed in terms of regular assessment of emotional state prior to neuropsychological testing, development of different sex norms for psychomotor tests and rearrangement/flexibility in the sequence of the Halstead-Reitan Battery.

35. Hembree, Howard W. and Carl E. Bledsoe
Component Development Test for Glove Shells, Leather, Contoured,
Wing Thumb
U.S. Army Natick Laboratories
Natick, Mass., 1964 (AD 857 789)

This Component Development Test was conducted in two separate wear phases. The first phase of the test was concerned only with subjective evaluations of the comparative fit, comfort and dexterity characteristics of the standard and experimental leather glove shells when worn both with and without wool glove inserts on the Dexterity Section of the FEA Handwear Testing Course. The second phase of the test was concerned with an evaluation of the comparative durability of the standard and experimental leather glove shells when worn with wool glove inserts on the Durability Section of the FEA Handwear Testing Course.

36. Hempel, Walter E., Jr. and Edwin A. Fleishman
A Factor Analysis of Physical Proficiency and Manipulative Skill
The Journal of Applied Psychology, 1955, Vol. 39, No. 1, 12-16

This paper reports on one in a series of factorial studies concerned with the organization of abilities in certain of the relatively unexplored aptitude areas of motor skill. Primary attention was given to the areas of gross physical proficiency and fine manipulative performance. Specifically, the analysis was undertaken (1) to investigate the interdependence of abilities contributing to individual differences in these two areas, and (2) to identify possible ability categories which might be useful and meaningful in describing performance in these areas.

The results indicate that the abilities contributing to performance on gross physical tasks are quite independent of those contributing to fine manipulative skill. Nine factors were identified in the physical performance tests and four factors were identified in the manipulative tests.

37. Imhoff, David L. and Jerrold M. Levine
Perpetual-Motor and Cognitive Performance Task Battery
for Pilot Selection
Technical Report No. AFHRL-TR-80-27
Manpower and Personnel Division
Brooks Air Force Base, Texas, 1981 (AD A094 317)

A review of the literature on pilot selection and training, perceptual-motor processes, and cognitive processes was conducted with the object of developing a test battery for the selection of candidates for pilot training. A large number of tasks that (1) reflected the abilities and processes important to piloting, and (2) showed evidence of producing reliable individual differences in performance, were identified and considered for inclusion in a test battery. Psychometric and pragmatic criteria were applied to the tasks in the candidate pool resulting in the selection of 15 tasks with apparent potential as pilot-selection devices for inclusion in the final battery. The tasks are described in detail to allow implementation on a computerized testing station.

38. Janson, William P. and Gary W. Jepson
Dexterity Degradation Study -- Phase II
Technical Report, AF Contract F33615-80-C-0514
MacAulay-Brown, Inc., Fairborn, Ohio, 1982 (unpublished)

Manual performance decrements caused by wearing various chemical protective glove combinations were investigated using a battery of standardized dexterity tests and a specially developed typing task. The current aircrew and ground crew glove combinations, as well as various prototype glove combinations, were included in the study. Six subjects completed the following tests: the Bennett Hand Tool Dexterity Test, the Minnesota Rate of Manipulation Test, the Crawford Small Parts Dexterity Test, the O'Connor Finger Dexterity Test, the Pennsylvania Bi-Manual Worksample Test, and the Key Punching Test. In addition to objective data, subjective data on glove damage and glove fit were also collected.

39. Jebsen, Robert H., Neal Taylor, Roberta Trieschmann, Martha J. Trotter, and Linda A. Howard
An Objective and Standardized Test of Hand Flexion
Archives of Physical Medicine and Rehabilitation, June 1969, 311-319

In this study seven tests of everyday activities were investigated for their effectiveness in assessing disabilities and effectiveness of therapy. The test items included: writing a short sentence, turning over 3" x 5" index cards, picking up small objects and placing them in a container, stacking checkers, simulated eating, moving empty large cans and moving weighted large cans. Data on 360 normal subjects and on patient groups are presented. These data suggest that the test can measure a broad spectrum of hand disability and is of value in assessing improvement in hand function gained by therapeutic procedures.

40. Johnson, Richard F.
Effects of Explosive Ordnance Disposal Armor on the Gross Body Mobility, Psychomotor Performance, Speech Intelligibility, and Visual Field of Men and Women
Report No. CEMEL-235
U.S. Army Natick Research and Development Laboratories
Natick, Mass., May 1981

Four commercially-available explosive ordnance disposal (EOD) suits were evaluated in order to determine their effects on the wearer's gross body mobility, psychomotor performance, speech intelligibility, and visual field. Six Army enlisted men and six Army enlisted women were tested under six conditions: (1) fatigues and combat boots, (2) fatigues and combat boots with infantry armor vest and helmet, (3) Commercial A EOD armor, (4) Commercial B EOD armor, (5) Commercial C EOD armor, and (6) Commercial D EOD armor. Although different in design, each EOD suit consisted of a helmet, face shield, torso armor, and upper and lower extremity armor. Commercial A and B EOD armor provided better mobility, psychomotor performance, speech intelligibility and field of vision than did Commercial C and D EOD armor. All four EOD suits were equivalent in terms of the wearer's ability to hear human speech accurately. Overall, test subject performance was best in Commercial A EOD armor and poorest in Commercial D EOD armor. There were no important differences between men and women in terms of ability to operate within the EOD suits.

41. Johnson, R.F.
The Effects of Elevated Ambient Temperatures and Humidity on Mental and Psychomotor Performance
Paper presented to the Thirteenth Commonwealth Defence Conference on Operational Clothing and Combat Equipment
Malaysia, 1981

This paper reports on a series of objective human performance tasks which were administered to personnel at various ambient temperatures and humidities. The investigation indicated that simple reactive tasks can be performed without degradation at all combinations of temperature and humidity tested, while complex mental tasks are hindered at elevated levels of temperature and humidity.

42. Johnson, Richard F. and Lynn A. Sleeper
Effects of Chemical Protective Handwear and Headgear
on Manual Dexterity
Paper submitted for publication in the Proceedings of the 1986 Annual
Meeting of the Human Factors Society.

During operations in a chemically contaminated environment, the combat soldier must wear, in addition to his normal combat uniform, a special chemical protective overgarment including jacket, trousers, overboots, rubber gloves, and a gas mask with hood. This clothing system was investigated for its impact upon the soldiers' ability to perform one-handed and two-handed tasks of manual dexterity, using the O'Connor Finger Dexterity Test and the Purdue Pegboard, respectively. The results of this study indicated that, compared to barehanded conditions, manual dexterity was substantially poorer with the gloved hand. In addition, learning of the manual tasks was slower under the gloved conditions. The difference in performance between barehanded and gloved conditions remained the same regardless of whether the soldier was wearing the gas mask with hood.

43. Jones, Marshall B., Robert S. Kennedy and Alvah C. Bittner, Jr.
A Video Game for Performance Testing
American Journal of Psychology, 1981, Vol. 94, No. 1, 143-152

This paper reports on one of the tests considered for inclusion in the Performance Evaluation Test for Environmental Research (PETER), a test battery designed to measure the effects of motion on performance. The test is a two-dimensional pursuit tracking task, called Air Combat Maneuvering (ACM), commercially available as an Atari video computer system game. This task was selected because it has substantial face validity for many tasks of military interest (e.g. radar and sonar interception) and because it is readily available and inexpensive. The purpose of the report was to determine how the ACM task behaves with testing over a three-week period; that is, at what point the task scores stabilize. Twenty-two subjects practiced the video game and results indicated complete stabilization after six days of testing.

44. Kellor, Margorie, Rosemary Kondrasuk, Iver Iversen, Judy Frost,
Norma Silberberg and Marilyn Hoglund
Technical Manual - Hand Strength and Dexterity Tests
Publication No. 721
Sister Kenny Institute, Minneapolis, Minn., 1977

This manual was written for physical therapists who test and interpret manual dexterity impairments. It provides descriptions and instructions for six tests -- Dynamometer, Palmer Pinch Test, Three-Point Pinch Test, Lateral Pinch Test, Nine-Hole Peg Test, and Fifty-Hole Beaded Peg Test. In order to establish norms, all six tests were given to 274 subjects ranging in age from 18 to 84. The subjects were drawn from all walks of life and were not handicapped. From the data, regression equations were derived and incorporated into graphs. From this, therapists can evaluate patients upon admission and measure their progress through a therapy program.

45. Kornse, Diane D., John L. Manni and Herbert Rubenstein
Developmental Apraxia of Speech and Manual Dexterity
Journal of Communication Disorder, 1981, Vol. 14, 321-330

The goal of this study was to determine if there is a relationship between speech apraxia and motor ability in young school children. Apraxia of speech is theorized to be due to a defect in the speech-motor control area within the left cerebral hemisphere. This area is believed to be very close to the area which controls fine motor coordination. The author hypothesized that finding a significantly lower performance of manual dexterity in children who have speech apraxia would support the idea that the impairment of speech is related to the left hemisphere. Scores from the Purdue Pegboard for 18 children with developmental apraxia of speech (DAS) were compared to scores of normal children. The groups were matched for intelligence and demographic variables. The data indicated no significant differences between groups, leading to the conclusion that DAS is not, in fact, due to a defect in the motor-speech area of the brain.

46. Lockhart, John M. and Harold O. Kiess
Auxiliary Heating of the Hands During Cold Exposure and
Manual Performance
Human Factors, 1971, Vol. 13, No. 5, 457-465

Twenty subjects performed five manual tasks barehanded during exposure to a 60°F ambient temperature control condition, to a 0°F condition, and to three ambient temperature conditions of 20°, 0°, and -20°F, in which auxiliary heat was applied to the hands. The tasks consisted of the Purdue Pegboard Assembly, Block-String, Minnesota Rate of Manipulation Placing, Knot-Tying, and Screw-Tightening Tasks, and were performed after exposure durations of 0, 60, 120 and 180 minutes. Exposure to the 0°F condition without auxiliary heat resulted in significant performance decrements on all tasks. The application of auxiliary heat to the hands resulted in the avoidance or alleviation of impaired performance during cold exposure depending upon the task, ambient temperature condition, and duration of exposure. The differential effects of auxiliary heat during cold exposure across manual performance tasks were related to the effects of auxiliary heat on hand skin temperature. These effects are discussed in terms of differential hand and finger dexterity, strength and speed of movement requirements across tasks.

47. Lockhart, John M., Harold O. Kiess and Thomas J. Clegg
Effect of Rate and Level of Lowered Finger Surface Temperature
on Manual Performance
Journal of Applied Psychology, 1975, Vol. 60, No. 1, 106-113

Thirty-two subjects were tested on six manual tasks when the right forefinger surface temperature was lowered to temperatures of 65°, 55° and 48°F after five to 50 minutes of cooling, or not lowered (for the control condition). Performances on all tasks (Block Packing, Block Stringing, Craik Screw, Knot Tying, Purdue Pegboard Assembly, and Screw Tightening) decreased with lowered surface temperature. The level of surface temperature associated with impaired performance and the extent of the performance decrements associated with additional cooling varied across tasks and cooling rates. How

the cold affected performance was dependent on the rate of cooling, the type of task, and individual subject differences.

48. McGinnis, John M., John M. Lockhart and Carolyn K. Bense
A Human Factors Evaluation of Cold-Wet Handwear
Report No. 73-23-PR
U.S. Army Natick Laboratories
Natick, Mass., 1972 (AD 756 417)

In this study five types of cold-wet handwear were compared to barehand performance on a battery of manual performance tasks (torque test, Minnesota Two-Hand Turning Test, O'Connor Fine Finger Dexterity Test, Cord Manipulation Test). For the dry glove investigation, each subject performed the tests under each handwear condition for 14 days at a 35°F ambient temperature. An additional wet-glove investigation involved the same tests and handwear conditions and was of four days duration. Results and recommendations are discussed in detail in the report.

49. McGinnis, John M., Carolyn K. Bense and John M. Lockhart
Dexterity Afforded by CB Protective Gloves
Report No. 73-35-PR
U.S. Army Natick Laboratories
Natick, Mass., 1973 (AD 759 123)

Three chemical and biological (CB) protective gloves were evaluated and compared to bare hands with regard to their effects on the performance of five tasks--torque test, Minnesota Two-Hand Turning Test, O'Connor Fine Finger Dexterity Test, Cord Manipulation and Cylinder Stringing Test, and Bennett Hand Tool Dexterity Test. On all four dexterity tasks, barehand performance was best and performance was worst when the butyl gloves were worn under the leather gloves.

50. Michaels, Joseph M. and William J. Rush, Jr.
Test Report for Chemical Warfare Defense Ensemble Gloves
QOT&E Report No. 82-AFCC783
1815th Test and Evaluation Squadron
Wright-Patterson Air Force Base, Ohio, 1982

The purpose of this study was to provide a valid estimate of the effectiveness and suitability of six Chemical Warfare Defense Ensemble (CWDE) gloves, as compared to the current glove, when worn in an operational environment. Areas evaluated included functional characteristics, environmental adaptability, durability, and ease of donning and doffing. Tasks used in this evaluation were primarily geared to communications operations and maintenance. The test was conducted with personnel wearing or not wearing the full CWDE to check out compatibility of the gloves with the suit. Flying operations were conducted at the Military Airlift Command at Pope Air Force Base, North Carolina. The off-the-shelf gloves manufactured by Brunswick provided greater dexterity and tactility than current inventory.

51. Morrison, Michael W., Robert J. Gregory and J. Joseph Paul
Reliability of the Finger Tapping Test and a Note on
Sex Differences
Perceptual and Motor Skills, 1979, Vol. 48, 139-142

The reliability of the Finger Tapping Test was investigated in two studies. In the test-retest condition, 30 male and 30 female college students were tested twice by the same examiner. In the inter-examiner condition, 30 male and 30 female college students were tested once by each of two examiners. Reliability coefficients for the dominant and nondominant hands were high in both studies (about .8) as contrasted with that of the ratio score (above .5), casting doubt on the use of the ratio score to make clinical inferences about lateralization of damage. Significant sex differences (males were about three taps faster) were found, calling into question the use of single test interpretation schemes. Slight inter-examiner differences in mean scores were also detected.

52. Pfitzer, John T.
Manual Dexterity, Grip Strength and Level of Endurance
Safety Office Headquarters
U.S. Army Materiel Command
Washington, DC, 1970 (AD 739 008)

This research is designed to answer the following questions: (1) Does prior loading in terms of grip-holding cause a decrement in manual dexterity? (2) If a decrement does exist, how long does it last? (3) Can decrement be predicted from the amount of endurance to which subjects are loaded?

In answering these questions, 10 male subjects were tested for manual dexterity using a Purdue Pegboard. These tests were presented before and after various conditions of grip loading, and differences in scores were analyzed. Conclusions were as follows: (1) Muscular loading in the form of grip-holding causes a decrement in manual dexterity. (2) The decrement lasts for a period of ten seconds or less. (3) There is a relationship between the amount of endurance required by loading and the decrement caused by that loading.

53. Reynolds, Bradley
The Effect of Learning on the Predictability of Psychomotor Performance
Journal of Experimental Psychology, 1952, Vol. 44, 189-198

This research was designed to study changes of test correlations with practice, and to ascertain whether the correlation of a psychomotor test and a set of printed tests decreases as a function of the amount of practice on the former.

Twenty printed tests from the Airman Classification Test Battery were given to 149 subjects. Subsequently, subjects were given six one-hour practice periods on the Complex Coordinator. Fifteen minutes were given between all periods except the third and fourth, where an hour was allowed for lunch. It was found that: (1) Correlation between two test periods decreased as a function of the amount of practice separating them. The distance between

scoring periods was found to have less effect upon the correlations than the amount of training preceding the periods. (2) The correlation between test periods increased as a function of the amount of practice preceding the first period. (3) These trends were disrupted by the interpolation of a rest period of sufficient length to produce decrements in performance. (4) The correlations of the psychomotor test with most of the printed tests decreased as a function of training on the psychomotor test.

54. Riley, Michael W. and David J. Cochran
Dexterity Performance and Reduced Ambient Temperature
Human Factors, 1984, Vol. 26, No. 2, 207-214

This study examined the dexterity performance of 35 male and 35 female subjects at ambient temperatures of 1.7°C, 12.8°C, and 23.9°C. Subjects wore typical industrial worker apparel without gloves. The Purdue Pegboard, two pencil-point tapping tasks, an assembly task, and a fine manipulative task were used to measure dexterity performance. Results indicate that after approximately 15 minutes of exposure there was no difference between performance at 12.8°C and 23.9°C, but there was a difference between performance at 1.7°C and 12.8°C as well as between performance at 1.7°C and 23.9°C. The decrement in performance at 1.7°C ranged from 0.3 to 15.7% when compared with performance at 23.9°C. In five of the 11 performance scores used, a difference due to sex was run, with males performing better on an assembly task and females performing better on single-activity, repetitive tasks. At the higher ambient temperatures (12.8°C and 23.9°C), the average of the minimum finger skin temperature for males was from 0.57° to 1.2°C higher than for females, whereas at 1.7°C there was no significant difference between the groups for minimum finger skin temperature.

55. Robinette, Kathleen M., Cay Ervin and Gregory F. Zehner
Dexterity Testing of Chemical Defense Gloves
AAMRL-TR-86-021
Harry G. Armstrong Aerospace Medical Research Laboratory
Wright-Patterson Air Force Base, Ohio, 1986

Four types of chemical defense gloves (12.5 mil Epichlorohydrin/Butyl, 14 mil Epichlorohydrin/Butyl, 14 mil Butyl and 7 mil Butyl with Nomex overgloves) were evaluated for their effect on hand dexterity. Fifteen male and 15 female subjects performed four dexterity tests (O'Connor Finger Dexterity Test, Pennsylvania Bi-Manual Worksample-Assembly, Minnesota Rate of Manipulation-Turning, and the Crawford Small Parts Dexterity Test-Screws) barehanded and while wearing the chemical defense gloves. Results indicated that subjects' performances were most impaired by the 7 mil Butyl with Nomex overglove. Though differences between the other three gloved conditions were not always statistically significant, subjects performed slightly better while wearing the Epichlorohydrin/Butyl gloves, no matter which thickness, than they did while wearing the 14 mil Butyl gloves. High negative correlations between anthropometry and gloves test scores of subjects suggested that poor glove fit may also have affected subjects' performances.

56. Salvendy, Gavrial and George P. McCabe, Jr.
Marijuana and Human Productivity, The Consumer Factor
Proceedings of the Seventeenth Annual Meeting of
the Human Factors Society
Santa Monica, California, 1973

Four groups (non-smokers, previous marijuana smokers, habitual marijuana smokers given placebos, and habitual smokers given marijuana) of 10 subjects each performed three psychomotor tasks (one-hole test, rotary pursuit and hand dynamometer). The results indicate a consistent pattern of inferior performance for the marijuana users on manipulative and coordination skills but not for strength attributes. The authors suggest caution in generalizing these results, however. The marijuana smoked was not provided by the experimenters and there was no accurate control over the quality of the marijuana with amount smoked before testing. Furthermore, the differences between groups could have been a function of factors other than marijuana effects (e.g. population characteristics).

57. Sand, Patricia L., Neal Taylor and Karen Sakuma
Hand Function Measurement with Educable Mental Retardates
The American Journal of Occupational Therapy, 1973, Vol. 27, No. 3
138-140

Manual dexterity and functional hand skills are often compromised in the mentally retarded, even when no gross physical impairment accompanies retardation. The Developmental Hand Function Test, consisting of seven timed functional hand activities, was administered to 28 educable mentally retarded (EMR) and 35 normal 12 to 14 year-old girls. Statistically significant differences between the performance of the EMR and normal girls occurred on six of the seven tasks. Nondominant hand function was relatively more impaired than was dominant hand function in the EMR girls. Implications for clinical use of hand function test results are discussed.

58. Seashore, Robert H.
An Experimental and Theoretical Analysis of Fine Motor Skills
American Journal of Psychology, 1940, Vol. 53, 86-98

This paper reviews theories on individual differences in motor skills and reveals the inadequacy of any single theoretical interpretation. The need for an eclectic examination of all theories is presented.

Correlational analysis of individual differences in sensori-motor coordinations had indicated the existence of certain group-factors or areas within which tests are at least moderately related. Examination of the nature of these groupings of tests showed that the boundaries of the groups usually cut across those of (1) specific musculature and (2) specific sense-fields.

Further examination of the groupings of such tests showed that the group-boundaries usually mark off a set of very similar patterns of movement (regardless of musculature), a functional rather than an anatomical grouping.

59. Seppala, T., R.L. Liljequist, M. Linnoila, K. Fredricson Overo and F. Dorrity
Correlations Between Serum Ami- and Nortriptyline Concentrations and Psychomotor Performance
Acta Pharmacology et Toxicology, 1977, Vol. 41, 472-480

Correlations of serum nortriptyline (NT) and amitriptyline (AT) levels with psychomotor performance, choice reaction performance, eye-hand coordination, and divided attention were studied in two experiments, each with 20 healthy subjects. In the first experiment, serum NT level was measured with an isotope derivative method after treatment for 14 days with NT. In the second trial plasma AT and NT concentrations were measured with gas-chromatography after treatment for 14 days with AT. No linear correlations between the levels of the antidepressants and performance variables were found. Low levels of NT tended to shorten reaction time, and intermediate levels to prolong it, when compared with the reaction times during placebo. The correlation between serum NT levels and the increase of the tyramine dose in the tyramine pressor test was not significant. A new assay method for AT and NT is presented.

60. Shingledecker, Clark A.
A Task Battery for Applied Human Performance Assessment Research
AFAMRL-TR-84-071
Aerospace Medical Research Laboratory
Wright-Patterson Air Force Base Ohio, 1984

The Criterion Task Set (CTS) VI.0 is a battery of tests designed to place selective demand on the elementary mental resources information processing functions of the human operator. Currently under development as a general purpose research tool for applied investigations of human performance capabilities, the CTS VI.0 includes nine standardized tasks which are implemented in user-friendly software on an inexpensive microcomputer system.

This interim report describes the historical basis of the CTS, the rationale used in its construction, and the parametric research conducted to establish standard loading levels, pacing rates, and training requirements for each of the tasks. Potential research applications of the CTS as well as planned developmental efforts intended to enhance its utility are discussed. Documentation for the CTS VI.0 is provided in the form of detailed individual task descriptions and brief summaries of hardware requirements and software characteristics.

61. Siegel, Arthur I. and Richard S. Lanterman
A Portable Test Battery for Comparatively Evaluating Operator Performance in Full-Pressure Suit Assemblies
AMRL-TR-68-74
Aerospace Medical Research Laboratory
Wright-Patterson Air Force Base, Ohio, 1968 (AD 680 825)

Recommendations for a portable battery of tests to assess human mobility in full-pressure suits are presented. The literature was reviewed to determine the types of instruments and tests employed by prior investigators.

Task analyses were performed on three advanced vehicles to determine the body-member-movement families most frequently involved. A set of tests and measurements is suggested for those member-movement families found to be most frequently involved in advanced flight. Necessary future steps for realizing the portable battery are suggested.

The test battery recommended includes the Purdue Pegboard for finger dexterity.

62. Taylor, R.M. and J.V.F. Berman
Ergonomic Aspects of Aircraft Keyboard Design: The Effects
of Gloves and Sensory Feedback on Keying Performance
Ergonomics, 1982, Vol. 25, No. 11, 1109-1123

This article discusses how increasing requirements for aircraft keyboards have revealed inadequacies in ergonomic standards for airborne environments, in particular for tasks involving unskilled discontinuous data entry with emphasis on accuracy rather than speed. The authors report on four experiments which suggest that kinesthetic and tactile feedback associated with keying are relatively unaffected by aircrew gloves, and that restrictions on mobility caused by gloves may be more important for continuous data entry involving relatively high keying rates.

63. Taylor, R.M. and J.V.F. Berman
Human Factors in Aircraft Keyboard Design: Standards, Issues and
Further Evidence Relating to Gloves and Key Characteristics
Conference Proceedings No. 329
Advisory Group for Aerospace Research & Development
7 Rue Ancelle 92200, Neuilly sur Seine, France, no date

The authors point out that most of the research on cockpit keyboards is based on the requirements of ground applications and do not take into account aircrew gloves, aircraft vibration, and the interference between keyboard data entry and other tasks performed concurrently in the cockpit.

The purpose of this paper is to summarize the outstanding issues and evidence pertinent to aircraft keyboard design, and to present the results of some recent experimental research at RAF Institute of Aviation Medicine.

64. Vittorio, P.V. and S.W. Cattroll
Dexterity Afforded by CW Protective Gloves
Technical Note No. 75-21
Defence Research Establishment Ottawa, Canada, 1975 (AD A017654)

The effects on manual performance of an experimental Canadian CW protective glove and U.S. and UK CW protective gloves were compared using five different manual tasks (Cord Manipulation and Cylinder Stringing, Minnesota Two-Hand Turning, Bennett Hand Tool Dexterity, O'Connor Fine Finger Dexterity and a torque test). The results show that, statistically, performance in three of the manual dexterity tasks was significantly better with the U.S. CW protective glove than with the Canadian or the UK CW protective gloves, and in

the same three tasks there was no significant difference in performance between the latter two gloves. Although the difference shown is statistically significant, its practical effect in the performance of military tasks may not be great.

65. Vittorio, P.V., R.W. Nolan and S.W. Cattroll
Dexterity Afforded by Experimental CW Protective Gloves
Technical Note No. 76-2
Defence Research Establishment Ottawa, Canada, 1976 (AD B010627)

The effects of modified Chemical Warfare (CW) protective gloves on manual performance, and their ability to withstand high torque values without destruction are described.

The manual performance of the CW gloves was compared to General Purpose (GP) gloves and bare hands using five different manual tasks (Cord Manipulation and Cylinder Stringing, Minnesota Two-Hand Turning, Bennett Hand Tool Dexterity, O'Connor Fine Finger Dexterity, and a torque test).

The results show that performance was significantly better with the bare hand for all tests except the torque test where the CW glove permitted the highest torque values with no visible signs of damage. The four remaining tests showed that the GP glove and the CW glove were not significantly different except in the Minnesota Two-Hand Turning Test where manual performance was slightly better with the GP glove.

66. Wickelgren, Wayne A.
Speed-Accuracy Tradeoff and Information Processing Dynamics
Acta Psychologica, 1977, Vol. 41, 67-85

The author contends that obtaining the speed-accuracy tradeoff function provides much greater knowledge concerning information processing dynamics than is obtained by a reaction-time experiment, which yields the equivalent of a single point on this function. He states that for this and other reasons, speed-accuracy tradeoff studies are often preferable to reaction-time studies of the dynamics of perceptual, memory, and cognitive processes. Methods of obtaining speed-accuracy tradeoff functions include: instructions, payoffs, deadlines, bands, response signals (with blocked and mixed designs), and partitioning of reaction time. He suggests a combination of the mixed-design signal method supplemented by partitioning of reaction times.

67. Wilson, Barbara C., John M. Iacoviello, James J. Wilson and Donald Risucci
Purdue Pegboard Performance of Normal Preschool Children
Journal of Clinical Neuropsychology, 1982, Vol. 4, No. 1, 19-26

Normative data on the Purdue Pegboard are presented, based on the performance of 206 right-handed male and female children between the ages of two years, six months and five years, 11 months. Results demonstrate developmental trends in the increased efficiency of peg placement for the right hand, left hand, and bi-manual conditions. Scores increased

monotonically with age; performances were stable, with high test-retest reliability. Continuity is evidenced between these data and those available for older children. Evidence for the disassociation of hand preference and peg placement efficiency in younger groups is discussed.

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